Landsat Data Continuity Mission (LDCM)
Acronym List and Lexicon

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1 Acronym List

ALI	Advanced Land Imager
ANSI	American National Standards Institute
ASQC	American Society for Quality Control
AVHRR	Advanced Very High Resolution Radiometer
BRDF	Bi-directional Reflectance Distribution Function
CC	Cloud Cover
CC	Cubic Convolution
CD	Compact Disk
CDR	Critical Design Review
CE	Circular Error
CE90	Circular Error 90% Probability
CFR	Code of Federal Regulations
CO	Contracting Officer
COFUR	Cost of Fulfilling User Requests
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off-The Shelf Software
DAAC	Distributed Active Archive Center
DOI	Department of Interior
DEM	Digital Elevation Model
DHF	Data Handling Facility
DN	Digital Number
DUNS	Data Universal Numbering System
EDC	EROS Data Center
EO-1	Earth Observing 1
EOS	Earth Observing System
EROS	Earth Resources Observation Systems
ETM+	Enhanced Thematic Mapper Plus
FAR	Federal Acquisition Regulation
FFRDC	Federally Funded Research and Development Center
FFT	Fast Fourier Transform
FGDC	Federal Geographic Data Committee
FTP	File Transfer Protocol
FWHM	Full-Width-Half-Maximum
GeoTIFF	Geographic Tagged Image File Format
GAO	General Accounting Office
GCP	Ground Control Point
GSD	Ground Sample(ing) Distance
GSFC	Goddard Space Flight Center
HDF	Hierarchical Data Format
HUB	Historically Underutilized Business
I&T	Integration and Test
IAS	Image Assessment System
IC	International Cooperator
IGS	International Ground Station

IOC	Initial Operating Capability
IRR	Integrated Requirements Review
ITAR	International Traffic in Arms Regulations
ITRF	International Terrestrial Reference Frame
ITRS	International Terrestrial Reference System
JPL	Jet Propulsion Laboratory
Lmax	Maximum Radiance
Ltypical	Typical Radiance
LDCM	Landsat Data Continuity Mission
LGS	Landsat Ground Station
LL	Lincoln Laboratory
LPM	Landsat Program Management
LPGS	Level 1 Product Generation System
LPS	Landsat 7 Processing System
LTAP	Long Term Acquisition Plan
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratory
MODIS	Moderate Resolution Imaging Spectroradiometer
MPR	Monthly Progress Review
MS	Microsoft
MTF	Modulation Transfer Function
MTFC	Modulation Transfer Function Compensation
NAD83	North American Datum of 1983
NASA	National Aeronautics and Space Administration
NDVI	Normalized Difference Vegetation Index
NEDT	Noise Equivalent Temperatures
NED	National Elevation Dataset
NFS	NASA FAR Supplement
NIMA	National Imagery and Mapping Agency
NIR	Near Infrared
NIST	National Institute of Standards and Technology
NLAPS	National Landsat Archive Production System
NN	Nearest Neighbor
NSLRSDA	National Satellite Land Remote Sensing Data Archive
NSTC	National Science and Technology Council
OMB	Office of Management and Budget
PCD	Payload Correction Data
PDD	Presidential Decision Directive
PDR	Preliminary Design Review
PER	Performance Evaluation Review
PF	Polarization Factor
PL	Public Law
PSR	Program Status Review
PST	Point Source Transmittance
RFP	Request for Proposal
RMP	Risk Management Plan
SDB	Small Disadvantaged Business

SF	Standard Form
SNR	Signal to Noise Ratio
SOW	Statement of Work
SRTM	Shuttle Radar Topography Mission
SWIR	Short Wave Infrared
TIM	Technical Interchange Meeting
TIS	Total Integrated Scatter
TRL	Technology Readiness Level
USG	United States Government
USGS	United States Geological Survey
VNIR	Visible and Near Infrared
WGS84	World Geodetic System 1984
WRS	Worldwide Reference System
WRS-2	Worldwide Reference System 2

2 Lexicon

Ancillary Data - The ancillary data shall consist of satellite and sensor housekeeping data, calibration data, and any other supplementary data required to generate the specified Level 1 data products.

Archive, LDCM Active - A data library (physical or logical) from which customers can search and order data products.

Archive, LDCM Long Term - The government facility/facilities providing a permanent repository for the data per the Land Remote Sensing Policy Act of 1992.

At-Aperture Radiance - The radiance at the aperture of the sensor.

Azimuth - Angle measured in the ecliptic or equatorial plane as part of a spherical polar coordinate system (radius or altitude, azimuth and elevation).

Band-to-Band Registration - The spatial registration between separate bands expressed in pixels. A measure of the spatial coincidence of corresponding samples from different bands.

Base Priority - The acquisition priority included in the LTAP Seasonality File (together with the date range for scene acquisition), which forms the basis for calculating overall acquisition priority scores.

Bi-directional Reflectance Distribution Function (BRDF) - A function that expresses reflectance from a surface into a unit projected solid angle as a function of both the direction of illumination and the direction of observation.

Bright Target Recovery - The recovery of the system from a saturation event such as a sun glint.

Browse Image - An image created to facilitate searching and screening of digital imagery contained within a database or archive. A browse image generally provides a simplified depiction of an archived image (e.g., at a coarser spatial resolution or from a subset of spectral bands) sufficient to assess the geographic area coverage, data quality, and spatial distribution of clouds within the archived image.

Circular Error (90%) (CE90) - Refers to the radius of a circle containing 90% of the individual measurements. A product with an accuracy of 100 meters CE90 means that 90% of the time geodetic positions derived from that product will be correct within a radius of 100 meters and 10% of the time the error will be greater than 100 meters. CE90 refers to accuracy in the horizontal plane only without regard to vertical (altitude) accuracy.

Cloud Cover (CC)- The area of cloud formations that, through direct obscuration, prevent or significantly hinder viewing of the Earth's surface.

Coherent Noise - A spurious, periodic pattern of noise within an image, generally of electronic origin.

Cost of Fulfilling User Requests (COFUR) - The incremental costs associated with providing product generation, reproduction, and distribution of unenhanced data in response to user requests. COFUR shall not include any acquisition, amortization, or depreciation of capital assets originally paid for by the United States Government or other costs not specifically attributable to fulfilling user requests.

Cubic Convolution (CC) Resampling - The cubic convolution technique, when spatially resampling image data points, assigns for each output pixel, a pixel value computed as a weighted combination of the sixteen surrounding input pixels. The input pixel value weights are computed based on the output pixel location relative to the surrounding input pixels, using a piece-wise cubic interpolation function.

Data Granule - An increment of image data stored in the archive or an increment of image data that can be inventoried and ordered as part of a data product.

Data Path - The sequence of space and ground assets that route LDCM image and housekeeping data from the observatory(ies) to the active archive.

Data Preprocessing - Processing of land remote sensing data that may include:

a) Rectification of system and sensor distortions in land remote sensing data as it is received directly from the satellite in preparation for delivery to a user.
b) Registration of such data with respect to features of the Earth.
c) Calibration of spectral response with respect to such data, but does not include conclusions, manipulations, or calculations derived from such data, or a combination of such data with other data.
(per Public Law 102-555)

Data Product - Digital image data, ancillary data and metadata produced and/or packaged for distribution.

Digital Elevation Model (DEM) - Digital representations of cartographic information in a raster form. DEMs consist of a sampled array of elevations for a number of ground positions at regularly spaced intervals.

Digital Image Data - Two-dimensional arrays of digital numbers, one per spectral band, representing a remotely sensed surface.

Digital Number (DN) - The radiance seen by the detector at each pixel converted to an electrical signal and then quantized to a discrete integer value.

Dynamic Range - The range of radiances over which instruments and sensors are sensitive. The upper end of the dynamic range is the saturation radiance. The lower end is the noise floor, i.e., the radiance corresponding to the low radiance noise level of the instrument. These radiances may be expressed as equivalent blackbody temperatures for thermal bands.

Earth Resources Observation Systems (EROS) - Established in the early 1970's under the Department of Interior's U.S. Geological Survey to receive, process and distribute data from the United States' Landsat satellite sensors and airborne mapping cameras.

Earth Resources Observation Systems Data Center (EDC) - A national archive, production, distribution and research facility for remotely sensed data and other geographic information (see EROS).

Edge Response - The response of an imaging system to an edge target (i.e., a low/high or high/low step function), normalized so that the mean response on the low side of the edge target is set to zero and the mean response on the high side of the edge target is set to 100%.

Ephemeris - A set of data that provides the assigned places of a celestial body (including a manmade satellite) for regular intervals. Ephemeris data helps to characterize the conditions under which remote sensing data are collected and may be used to correct the sensor data prior to analysis.

Federal Geographic Data Committee (FGDC) - Established by the Office of Management and Budget for purposes of coordinating the development, use, sharing and dissemination of geographic data.

Geodetic - Of or determined by geodesy; that part of applied mathematics which deals with the determination of the magnitude and figure either of the whole earth or a large portion of its surface. Also refers to the exact location points on the earth's surface.

Geodetic Accuracy - The accuracy with which geographic position and elevation of features on the earth's surface are mapped. This accuracy incorporates information in which the size and shape of the earth has been taken into account.

Geodetic Reference System - A comprehensive geodetic model of the Earth including a geodetic reference frame, a best-fit Earth ellipsoid/spheroid model, and an Earth gravitational model. The inclusion of all these components allows a geodetic reference system to serve as a horizontal and vertical datum. The standard LDCM geodetic reference system is the World Geodetic System 1984 (WGS84).

Granule - See **Data Granule**.

Ground Control Point (GCP) - A geographic feature of known location that is recognizable on images and can be used to determine geometric correction functions for those images.

Ground Sample Distance (GSD) - The distance on the ground between adjacent image sample (pixel) centers.

Height - The distance of a point from a vertical reference surface. The standard LDCM height reference is the surface of the WGS84 Earth ellipsoid. This is distinct from the point's elevation,

which is measured relative to the geoid - the gravitational equipotential surface corresponding to mean sea level - which undulates relative to the WGS84 Earth ellipsoid.

Horizontal Error - The difference, in meters, between a point's measured horizontal position (e.g., latitude and longitude) and the true horizontal position.

Housekeeping Data - Housekeeping data is meant to be a comprehensive term covering all data about the spacecraft and instrument(s) that provide quantitative information on their status and state(s) including metrics such as on/off flags, temperatures, voltages and currents.

Image-to-Image Registration - The spatial registration between images acquired at different times.

Image Compression - The process of reducing the amount of data required to represent the information present with an image.

Imax - The maximum response of an instrument as a polarizer analyzer is rotated.

Imin - The minimum response of an instrument as a polarizer analyzer is rotated.

Inherent Band Registration - A measure of the spatial coincidence of corresponding samples from different LDCM spectral bands, achievable without spatial interpolation (i.e., using only integer pixel shifts to compensate for data timing and formatting offsets).

Inoperable Detector - A detector that does not meet the definition of operable detector (see **Operable Detector**).

International Cooperator (IC) - Any non-U.S. organization having signed an agreement or a contract to routinely receive LDCM data.

Land Remote Sensing - Public Law 102-555 defines "land remote sensing" as: "…the collection of data which can be processed into imagery of surface features of the Earth from an unclassified satellite or satellites, other than an operational United States Government weather satellite."

Landsat Program Management (LPM) - Landsat Program Management consists of the Administrator of NASA and the Secretary of the Interior. The October 16, 2000 Amendment to Presidential Decision Directive/NSTC-3 states that "the Secretary of the Interior and the Administrator of NASA are hereby designated as members of the Landsat Program Management in accordance with section 101(b) of the Land Remote Sensing Policy Act of 1992." The Amendment further assigns NASA and DOI/USGS the responsibility for "maintaining continuity of Landsat-type data beyond Landsat 7" under direction of Landsat Program Management.

LDCM Contractor - The private owner of the remote sensing system from which NASA and DOI/USGS will procure land remote sensing data for the LDCM. This private organization will

be selected competitively through a joint NASA-USGS procurement based on Federal Acquisition Regulations.

LDCM Data - Unprocessed land remote sensing data directly generated by the LDCM Sensors and procured by NASA and DOI/USGS per the specifications defined by the LDCM. LDCM Data also include metadata, browse and ancillary data associated with the LDCM Data and Data Products.

LDCM Data Products - Products derived from LDCM Data. These products will contain either unprocessed LDCM Data or preprocessed LDCM Data. The LDCM Data Products containing unprocessed LDCM Data are referred to as Level 0 data products and may be proprietary. The LDCM Data Products containing preprocessed LDCM Data are referred to as Level 1 data products and are in the public domain.

LDCM Sensors - The instruments that acquire and generate the land remote sensing data that will be procured by NASA and DOI/USGS under the LDCM.

LDCM User - Any person or institution who orders or uses the LDCM data or specified data products, which includes, but not limited to, government, academia, commercial users, the general public and people from other countries.

Level 0 Data Products - Data products containing unprocessed data in original measured values that have had all transmission and formatting artifacts removed plus any necessary ancillary or supplementary data required to produce higher-level products (Level 1R, Level 1G). Metadata which describes the contents of each Level 0 data set are also considered part of the Level 0 data products.

Level 1 Data Products - Data products containing preprocessed data including Level 1R data products and Level 1G data products.

Level 1G Data Products - End-user data products, derived from Level 0 data products, that have been both radiometrically corrected, in the manner of Level 1R data products, and geometrically corrected for registration to a ground referenced cartographic grid. Metadata which describes the contents of each Level 1G data set are also considered part of the Level 1G data products.

Level 1Gs Data Products - Level 1G data products that have been geometrically corrected, using knowledge of the collection system's geometric characteristics, to provide a basic level of geodetic accuracy relative to the WGS84 geodetic reference system.

Level 1Gp Data Products - Precision corrected Level 1G data products, potentially employing ground control points, to provide an enhanced level of geodetic accuracy relative to the WGS84 geodetic reference system.

Level 1Gt Data Products - Orthorectified Level 1G data products, employing digital elevation models, to provide the highest level of geodetic accuracy relative to the WGS84 geodetic reference system including compensation for the effects of terrain relief.

Level 1R Data Products - End-user or intermediate data products, derived from Level 0 data products, containing radiometrically corrected image data that are linearly scaled to radiance at the collection system aperture, as well as ancillary data needed to create Level 1G data products, and metadata describing the Level 1R data product.

Long-Term Acquisition Plan (LTAP) - The algorithms used to prioritize image acquisitions based on minimizing cloud cover and acquiring seasonal temporal coverage.

Lossy Compression - An image compression process such that the original image is slightly degraded when uncompressed.

Metadata - An archived set of descriptive information about a scene and the parent sub-interval that provides a user with geographic coverage, date of acquisition, sun angles, cloud cover, gain states, and other quality measurements.

Modulation Transfer Function (MTF) - The magnitude of the Fourier transform of the line spread function of the imaging system.

Modulation Transfer Function Compensation (MTFC) Resampling - The modulation transfer function compensation resampling technique assigns a value to each output (resampled) pixel, computed as a weighted combination of the surrounding input pixels. The input pixel value weights are computed based on the output pixel location relative to the surrounding input pixels, using an interpolation function with a spatial frequency response that has been designed to compensate for the spatial frequency attenuation characteristics of the imaging system's modulation transfer function.

Nadir - That point on the celestial sphere vertically below the observer, or 180¡ from the zenith.

Near Infrared - The spectral region covering 700-1000 nm.

Nearest Neighbor Resampling (NN) - The nearest neighbor technique, when correcting image data points, assigns for each new pixel, that pixel value, which is closest in relative location to the new, computed pixel location.

Noise Equivalent Delta Temperature (NEDT) - A measure for thermal channels that gives the temperature difference that would be masked by the total noise signal.

Observatory - A complete space based remote sensing system that provides all required spacecraft bus functions (attitude control, communications, structure, thermal, power, propulsion, command and data handling, data storage and transmission) as well as the necessary instruments and sensors to capture radiances and transmit required imagery for a particular mission.

Operable Detector - A detector shall be defined as operable, even if out of spec, if it meets the following requirements:

a) The detector shall be sensitive to photons within its spectral band and not be saturated at expected operating temperatures under dark conditions.
b) The detector's noise shall be less than 5 times the mean noise level for the band on which it occurs.
c) The detector's dark current shall remain within +/- 5 times the RMS noise over the period between dark frame references.
d) The detector's dynamic range shall be greater than 25% of the specified dynamic range.

Orthorectified - Describing an image in which terrain relief distortions have been removed.

Overshoot - The difference between the maximum value of the normalized edge response and the mean response on the high side of the edge target (100% by definition) or the absolute value of the difference between the minimum value of the normalized edge response and the mean response on the low side of the edge target (zero by definition).

Polarization Factor (PF) - The modulation ratio PF = (Imax-Imin)/(Imax+Imin) associated with a polarization sensitivity measurement.

Polarization Sensitivity - The sensitivity of the system to changes in the polarization of the signal.

Primary Distribution - Data or data product(s) provided by the initial supplier/vendor to an initial customer, also simply called distribution.

Radiometric Reference Sources - Examples of possible radiometric reference sources and geometric targets include: calibration lamps, integrating spheres, diffusion panels, vicarious calibration sites, and astronomical targets such as deep space and the moon.

Redistribution - See **Secondary Distribution**.

Sample Direction - The column dimension of a two-dimensional digital image. A pixel's sample number corresponds to its column number.

Scattered Light - Undesired light contamination projected on a focal plane caused primarily by uneven surface features on optical surfaces. This optical surface roughness is usually measured by performing a BRDF measurement for each optical surface.

Secondary Distribution - Data or data product(s) provided by one customer to another, sometimes called redistribution.

Sharpening Band - Single spectral band having a finer spatial resolution than the other bands, usually in an integer multiple, which allows for sharpening of the multispectral bands.

Signal-to-Noise-Ratio (SNR) - The ratio of the level of the information-bearing signal power to the level of the noise power. More precisely, the signal-to-noise ratio of the mean digital number (DN) to the standard deviation in DN. This is a temporal noise definition in that the mean DN is

the time averaged value and the standard deviation in DN is the standard deviation in the time series.

Single Sharpening Band Ground Sample Distance - The ground sample distance for the sharpening band.

Solar Illumination - The solar illumination geometry for which data will be acquired.

Spatial Coverage -The areas of the earth that will be accessible from the observatory.

Special Requests - Data acquisition requests that include temporal and spatial requirements (and potentially cloud cover requirements). Special requests will be used for specific acquisition needs, such as coverage of natural disasters, coordinated acquisitions with other sensors, and calibration acquisitions.

Spectral Band - An interval in the electromagnetic spectrum commonly designated by a spectral bandwidth and a center wavelength.

Spectral Bandwidth - The wavelength interval between the lower and upper band edges. The lower band edge is the lowest wavelength where the relative spectral radiance response is 50% of the peak response. The upper band edge is the highest wavelength where the relative spectral radiance response is 50% of the peak response.

Spectral Band Center Wavelength – A wavelength within a spectral band, halfway between the lower and upper band edges.

Stability - The variability as a function of time of the radiometric accuracy of the system.

Stray Light - Light scattered onto a detector from areas outside a specified solid angle.

Supplementary Data - Data that are not acquired on board the LDCM observatory(ies). Examples of possible supplementary data sets include, but are not limited to, ground control point libraries and digital elevation models (DEM).

Swath - The strip on the Earth that the instrument observes as it passes overhead.

Telemetry - Includes information on the health and status of the spacecraft and its payload.

Temporal Resolution - The expected repeat time between measurements over the same geographic location.

Thermal Infrared- The spectral region from 3 to 14 μm that is employed in remote sensing. This spectral region spans the radiant power peak of the earth.

Unenhanced Data - Land remote sensing signals or imagery products that are unprocessed or subject only to data preprocessing. (see definition of **Data Preprocessing)** (per Public Law 102-555)

Unprocessed Data - Formatted or raw bit LDCM digital image and ancillary data which could be corrected for space to ground transmission errors.

User - See **LDCM User**.

Value-Added Data Products - Any products derived from LDCM Data processed or enhanced beyond the steps defined as data preprocessing.

Viewing Geometry -The viewing geometry for which the data shall be acquired, characterized by the zenith and azimuth angles from a ground point to the sensor, at the time of observation.

Visible - The spectral region covering 400-700 nm.

World Geodetic System 1984 (WGS84) - A global geodetic reference system defined and maintained by the National Imagery and Mapping Agency (NIMA). WGS84 is the standard geodetic reference system for LDCM. For remote sensing applications such as LDCM, WGS84 can be considered to be functionally equivalent to the International Terrestrial Reference System (ITRS) and its International Terrestrial Reference Frame (ITRF) realizations.

Worldwide Reference System-2 (WRS-2) - WRS-2 was created to define geographic coordinates along an orbital path to delineate the center points of Landsat 4/5 Thematic Mapper scenes. It is a framing grid derived from a sun-synchronous orbital track with a 705 Km altitude at the equator, a 98.2° orbital inclination and a 16-day repeat cycle. Path one is aligned to cross the descending node at 64.6° west longitude with path numbers increasing to the west. The grid rows are registered such that the center point of row 60 falls on the equator of the descending node with row numbers increasing along the orbital track. Each scene center point is separated by approximately 23.9236 seconds of spacecraft nadir ground trace time. The resulting grid has 233 paths (repeating orbit tracks) and 248 rows (scene centers per path).

Zenith - The point in the celestial sphere that is exactly overhead.

Zenith Angle - The angle between the sun and the zenith for a given position on the Earth's surface. Also, the complement of the angle between the horizon and the sun (solar elevation).